

matter of considerable interest to have a new fern recorded from the Coal-measures. The plant, consisting of axis, petioles, and root, is described by Miss M. C. Stopes in the *Memoirs of the Manchester Literary and Philosophical Society*, vol. 1., part x.; associated with these fossil remains are small annulate sporangia which, there is every reason to believe, belong to the same plant. The plant is referred to *Tubicaulis*, a fern genus, formerly monotypic, that is probably one of the simpler *Botryopterideæ*.

THE Field Naturalists' Club of Victoria, which has been in existence twenty-six years, appears to be in a very satisfactory condition, financially, numerically, and in the interest shown in the monthly meetings. During the year which ended in April last, eight papers relating to zoology were read; eleven papers dealt with botany, two with geology, and one with palæontology. The president (Mr. F. G. A. Barnard) at the annual meeting took as the subject of his address "The First Quarter of a Century of the Field Naturalists' Club of Victoria," from which we notice there are still thirteen of the original members in association with the institution.

THE *National Geographic Magazine* (the organ of the National Geographic Society of Washington) maintains its high standard of excellence, and the August issue—devoted mainly to South America—contains many articles of interest, notably one by Prof. A. Heilprin on the shattered obelisk of Mont Pelée, which is illustrated by reproductions of several striking photographs of the peculiar cone of rock which was thrown up during the volcanic activity of the mountain a few years ago, and which at the time of its greatest development attained the height of more than a thousand feet. To-day the obelisk is in ruins, consisting of boulders ranging from 2 feet or 3 feet in diameter to 30 feet, and it was to view these and to endeavour to understand the geological riddle of the mountain that Prof. Heilprin in February last paid his fourth visit to Martinique.

A FIFTH edition has been published by Messrs. Swan Sonnenschein and Co., Ltd., of "Through the Wordsworth Country: A Companion to the Lake District," by Prof. William Knight, with sixteen full-page illustrations by Mr. Harry Goodwin. In an explanatory preface Prof. Knight explains his aim as having been to be as terse and simple as possible, and not to traverse precisely the same ground as that covered in one of his earlier works. He modestly insists more than once that the merit of the book rests on Mr. Goodwin's drawings and certainly these are delightful, but lovers of Wordsworth visiting the Lake District will also find Prof. Knight an interesting and inspiring guide.

OUR ASTRONOMICAL COLUMN.

COMET 1906d (FINLAY).—A further extract from M. Schulhof's ephemeris for Finlay's comet, as published in No. 4109 of the *Astronomische Nachrichten*, is given below:—

Ephemeris (12h. M.T. Paris).

1906	α (app.) h. m. s.	δ (app.) ° ' "	$\log \Delta$	$1:r^2\Delta^2$
Aug. 18 ...	4 11 49 ...	+10 21 ...	9.44499 ...	12.56
20 ...	4 26 35 ...	+11 33 ...	9.45816 ...	12.02
22 ...	4 40 34 ...	+12 39 ...	9.47221 ...	11.44
24 ...	4 53 48 ...	+13 38 ...	9.48689 ...	10.85
26 ...	5 6 19 ...	+14 31 ...	9.50197 ...	10.25

From this it will be seen that the comet is now apparently travelling through Taurus towards the northernmost extremity of Orion, and will be about 4° south of Aldebaran on August 21, on which date it will rise a little north of east at about 12 o'clock (midnight).

NO. 1920, VOL. 74]

PLANETS AND PLANETARY OBSERVATIONS.—In the second of the series of articles which he is writing for the *Observatory*, Mr. Denning discusses the powers best suited for planetary observations, the best times for making the observations, and the *modus operandi* most suitable for observers with moderate equipments.

In this he emphasises the importance of noting every detail very carefully, and of keeping any one object under regular observation for as long a period as possible.

In a discussion as to the relative values of eye-estimates and instrumental observations of transit times, Mr. Denning supports the former method (the *Observatory*, No. 373).

A NEW FORM OF SPECTROHELIOGRAPH.—A new form of spectroheliograph, in which it is hoped that the effects of instrumental vibrations will be materially reduced, is proposed by MM. G. Millochau and M. Stefánik in No. 1, vol. xxiv., of the *Astrophysical Journal*.

This instrument may be fed from a cœlostast or siderostat, or attached directly to a telescope. It is moved about a horizontal axis perpendicular to the plane containing the optical axes of the spectrograph by a Brashear clepsidra mounted vertically.

By widening the primary slit at its two extremities, a photograph of a portion of the spectrum of the diffuse skylight may be obtained, thus giving an indication of the exact radiation which is being employed.

THE RELATIONS BETWEEN SCIENCE AND INDUSTRY.

THIS year's meeting of the Association française pour l'avancement des Sciences was held at Lyons, and opened on the same day as the meeting of the British Association at York. On August 1, Prof. G. Lippmann, the president of the French association, delivered his presidential address,¹ and by a significant coincidence dealt with the want of respect accorded to scientific research by French manufacturers and merchants on the same day that Prof. E. Ray Lankester was directing the attention of visitors to York to the "less widespread interest than formerly in natural history and general science, outside the strictly professional arena of the school and university."

Prof. Lippmann found the text of his discourse in the success which has followed the attempts of the manufacturers of Lyons to benefit fully by the work accomplished by men of science. At Lyons, he said, "science and industry live together in harmony." In this district scientifically organised factories are to be found, in which it is recognised that science can give daily assistance to industrial development—a truth other parts of France are, said Prof. Lippmann, far from understanding. The mistake is too common that industry only has need of technicians, or, at least, that she need trouble only about "applied" science, taught specifically with a view to the various manufactures; and this tendency the president described as the fatal error which had caused the total production of French industries to fall from the first to the fourth rank. It is the duty of every man of science, he continued, to wage war on such false ideas, wherever met, and to substitute for them the salutary truth that success in industry is founded upon a proper regard for the methods of science. For this reason, he explained, he had decided to speak on the relations between science and industry.

It is easy to define the bond which unites science to industry. There is only one nature. The forces which mould the material world are those also which inspire the apparatus of the laboratory, which are utilised in industry, and in the arts of peace and of war. There is one science only, which is neither professorial, industrial, civil, nor military. Experimental science is the art of wielding the forces of nature—and industry and science are developed along parallel lines.

During an unknown number of centuries science was empirical and industry mere fumbling and groping. In the last hundred years science has developed more than in thousands of years previously, and industry has advanced with giant's strides. Prof. Lippmann exemplified his statements by reference to the chemical and industrial industries, and paid eloquent tributes to the creator of the

¹ The address is printed in the *Revue Scientifique* for August 11, 1906.

first wheel and the discoverer of fire. These examples prepared the way for a consideration of the conditions, other than those of the researches of the laboratory, to which industrial work is subject. The burden of the president's remarks was that nothing is too insignificant for careful attention, and that qualified workmen require long training.

A well-instructed technical staff is indispensable to every works; the men may be prepared in special schools, but their work must be learnt in the shop itself, for it can be learnt properly nowhere else. It is equally important that the managers of the factory be properly trained and be provided with research laboratories where trials should be made with an automatic regularity.

But even when all these things have been provided there should be no standing still. In industry, said Prof. Lippmann, one is never tranquil. When everything has been provided for, there is still the unforeseen, and the rivalry of other producers at home and abroad has always to be reckoned with. "Industry is a struggle without end and without truce."

The president then went on to show how, as science made new discoveries, technical experience became insufficient, and without scientific assistance an industry must fall behind. He insisted upon the value of mathematics, and explained that all the resources of mathematical analysis can be brought into requisition in industrial undertakings, instancing the way in which Lord Kelvin found by analysis the cause of the remarkable slowness with which electric signals traversed the Transatlantic cable at the time it was being laid. He then gave other instances of how men of science have provided new resources to the industrial expert, and concluded by again urging the need at every factory for a scientific staff provided with research laboratories.

Such a procedure, Prof. Lippmann went on to point out, is common in Germany and in America; and Austria and Switzerland are, he added, adopting the same method. But no mention was made of Great Britain. Evidently the president felt that French disregard of the value of science was reflected across the Channel, and no instance of British enterprise seems to have presented itself to him. Germany, however, has had the good sense to set an example to the nations. The great German manufacturing houses know the value of the man of science. In the Zeiss works at Jena, fourteen Doctors of Science are employed, and these include mathematicians as well as physicists. The great German aniline colour works employ more "scientific" than "technical" chemists. At one of them, for instance, fifty-five scientific and thirty-one technical chemists are engaged; at a second, 145 scientific chemists and 175 technologists; at a third 148 scientific chemists for 75 technists. The research laboratories of these works are lavishly equipped; one of them possesses a library of 14,000 volumes; a second spends 150,000 francs a year on glass-ware. These things are no doubt expensive, but these great factories still manage to pay a dividend of from 20 to 30 per cent.

Every newly-discovered substance which is usable is patented, and in this way Germany has managed to establish a monopoly. The house of Baeyer possesses a thousand patents at home and 1200 in foreign countries. Germany exported, in 1904, 195 times as much aniline colours as France. The German plan, said Prof. Lippmann, is a good one; the French method is bad.

American procedure was then described, and a word or two said about the methods being adopted in Austria and Switzerland.

French shortcomings were next passed in review and condemned unreservedly. French manufacturers, said the president, consider mathematicians, physicists, and chemists as expensive luxuries, and engage very few of them. They do not recognise the value and significance of the discoveries of French men of science. The instance of Carnot's researches on heat-engines was cited, and the value they had been in England as compared with the extent to which they had been utilised in France was traced. The scientific spirit, continued the president, is less developed in France than in other European countries, less developed than in America and Japan. The national industries have suffered profoundly from this weakness, and

the lack of scientific spirit is felt in other directions. The cause of this deficiency is in no sense due to a want of national ability. Prof. Lippmann put it down to an antiquated system of public education. French education, he assured his audience, is Chinese in origin as well as in character.

The president in directing attention to higher education in France saw in this direction cause for hope and the remedy for the shortcomings he had previously enumerated. In countries where the conditions of culture are normal, every young man to whom it is desired to give a liberal education is sent to a university, not for reasons of vanity, but because it is necessary for the youth's professional future. This necessity is not, Prof. Lippmann maintained, sufficiently understood in France. The young man should go to the university not only to learn law or medicine, but in order to become a cultured man.

The chief business of the university is to teach the art of research, that is to say, science, for science is the art of research and nothing else; and research is indispensable to industry. At the same time, the university must put men with no scientific ambitions, but who wish to acquire a general culture worthy of the name, in touch with science at first hand, for science in the making is alone attractive and fruitful. The French universities are at present too much under the influence of a bureaucratic pedantry to accomplish this double function, and the sooner they are liberated from the yoke of the executive power the better according to the president. So far as unfettered universities are concerned, France is, in Prof. Lippmann's view, behind the rest of the world except Spain.

Prof. Lippmann concluded by expressing the devout hope, in the name of industry and of national development, that the teaching of science in France may be delivered soon from all ancient fetters.

THE BRITISH ASSOCIATION.

SECTION C.

GEOLOGY.

OPENING ADDRESS BY G. W. LAMPLUGH, F.R.S.,
PRESIDENT OF THE SECTION.

ON BRITISH DRIFTS AND THE INTERGLACIAL PROBLEM.

If a personal reminiscence be pardonable, let me first recall that twenty-five years ago, at a meeting of this Section in this same room, I ventured, while still a youth, to contribute my mite towards the right understanding of the Yorkshire drifts. The occasion will always remain memorable to me, for it was my first introduction to a scientific audience, and the encouraging words spoken by Ramsay from this chair impressed themselves upon me and gave me confidence to persevere in the path of investigation.

Finding myself again in these surroundings, it seems fitting that with fuller experience and less diffidence I should resume the subject by bringing before you some further results of my study of the drifts. But it is with just a sigh that I recollect how on the former occasion I was able to reach a definite conclusion on a simple problem from direct observation, and had confidence that all problems might be solved by the same method; whereas now I find confronting me an intractable mass of facts and opinions, of my own and other people, terribly entangled, out of which it seems to grow ever more difficult to extract the true interpretation.

That the glacial deposits possess some quality peculiarly stimulating to the imagination will, I am sure, be recognised by everyone who has acquaintance with glacialists or with glacial literature. The diversity and strongly localised characters of these deposits, together with their aspect of superficial simplicity, offer boundless opportunity to the ingenious interpreter; and therefore it is not surprising that along with the rapid accumulation of facts relating to bygone glaciation there should have arisen much divergent opinion on questions of interpretation. Nor need we regret this result, since these differences of opinion have again and again afforded the stimulus for research that would not otherwise have been undertaken.